

## REMARKS

Reconsideration of this application, as amended, is respectfully requested.

Claims 1-6 and 8-15 are pending. Claims 1-6 and 8-15 stand rejected.

Claims 1, 13, and 15 have been amended. Claim 10 has been canceled. No claims have been added. Support for the amendments is found in the specification, the drawings, and in the claims as originally filed. Applicants respectfully submit that the amendments do not add new matter.

## REJECTIONS UNDER 35 U.S.C. § 103

Claims 1, and 8-11 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,814,861 of Schunke et al. (“Schunke”). Claim 2 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Schunke in view of U.S. Patent No. 5,970,351 of Takeuchi (“Takeuchi”). Claim 3 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Schunke as applied to claims 1, and 8-11 above, and further in view of U.S. Patent No. 6,057,582 of Choi (“Choi ’582”). Claim 4 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Schunke in view Takeuchi as applied to claim 2 above, and in further view of Choi. Claims 5 and 6 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Schunke as applied to claims 1, and 8-11 above, and further in view of U.S. Patent No. 5,793,088 of Choi et al. (“Choi ‘088”). Claim 12 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Schunke as applied to claims 1, and 8-11 above, and further in view of U.S. Patent No. 5,567,966 of Hwang (“Hwang”). Claim 13 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Schunke in view of U.S. Patent No. 6,274,894 of Wieczorek et al. (“Wieczorek”) in further view of Takeuchi.

Applicants have amended claim 1 to particularly point out that a pair of silicon or silicon alloy inwardly concaved source/drain regions of a second conductivity type in the recesses in the substrate on opposite sides of the gate electrode have a concentration of

impurities in a range of  $1 \times 10^{18}/\text{cm}^3$  to  $3 \times 10^{21}/\text{cm}^3$ . Such a pair of silicon or silicon alloy inwardly concaved source/drain regions having the concentration of impurities in the range of  $1 \times 10^{18}/\text{cm}^3$  to  $3 \times 10^{21}/\text{cm}^3$  directly defines a first channel region having a first metallurgical channel length directly beneath the lower portion of said gate electrode in the first conductivity type region, and a second channel region having a second metallurgical length between the metallurgical inflection points.

The Examiner acknowledged that “Schunke does not disclose the concentration of the deposited silicon or silicon alloy source/drain regions of a second conductivity type having a concentration between  $1 \times 10^{18}/\text{cm}^3$  to  $3 \times 10^{21}/\text{cm}^3$  or approximately  $1 \times 10^{21}/\text{cm}^3$ ” (Office Action, p. 3, 09/19/05). The Examiner contends, however, that “it would have been obvious to one of ordinary skill in the art at the time of invention was made to use these concentrations in order to form source and drain regions that are capable of forming a channel therebetween, and since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art”.

Applicants respectfully disagree. It is respectfully submitted that Schunke teaches away from the claimed subject matter.

Schunke discloses a transistor having a lightly doped drain. Schunke discloses the necessity to reduce the electrical field beneath the gate electrode in the vicinity of a source/drain region to reduce hot electron phenomena in MOSFET that negatively affect a device performance (col. 1 line 14- col. 3 line 44). More specifically, Schunke discloses implanting ions into the substrate at a low concentration in the range of about  $1 \times 10^{12}/\text{cm}^3$  to  $5 \times 10^{13}/\text{cm}^3$  on opposite sides of gate electrode to form source/drain regions to reduce the electrical field beneath the gate electrode in the vicinity of source/drain regions. In

particular, Schunke, as shown in Figure 6, discloses source / drain regions 50 and 52 having an impurity profile that decreases from  $1 \times 10^{15}/\text{cm}^3$  to  $1 \times 10^{13}/\text{cm}^3$  towards channel region 44.

Further, Schunke discloses

FIG. 7 is a graph illustrating the concentration profile of the symmetrical vertical MOSFET after ion implantation. As illustrated, each of the source and drain regions is connected to the channel region through an intermediate region A and B of relatively low concentration. The regions A and B correspond to the impurity concentration which results from step regions 42 and 40, respectively.

(Schunke, col. 6, lines 1-7) (emphasis added)

Thus, Schunke discloses source/drain regions having the impurity profile that decreases from  $1 \times 10^{15}/\text{cm}^3$  to  $1 \times 10^{13}/\text{cm}^3$  towards channel region 44, such that each of the source and drain regions is connected to the channel region through the regions of relatively low concentration of  $1 \times 10^{15}/\text{cm}^3$  to  $1 \times 10^{13}$  in contrast to the source and drain region having a concentration of impurities in a range of  $1 \times 10^{18}/\text{cm}^3$  to  $3 \times 10^{21}/\text{cm}^3$  that directly define a first channel region having a first metallurgical channel length directly beneath said lower portion of said gate electrode in said first conductivity type region, and a second channel region having a second metallurgical length between said metallurgical inflection points, as recited in amended claim 1.

Thus, Schunke does not disclose, teach or suggest and in fact teaches away from limitations of amended claim 1 of a pair of silicon or silicon alloy inwardly concaved source/drain regions of a second conductivity type having a concentration of impurities in a range of  $1 \times 10^{18}/\text{cm}^3$  to  $3 \times 10^{21}/\text{cm}^3$  that directly define a first channel region having a first metallurgical channel length directly beneath said lower portion of said gate electrode in said first conductivity type region, and a second channel region having a second metallurgical length between said metallurgical inflection points.

Furthermore, even if the MOSFET of Schunke would have source/drain regions with the impurity profiles varying in concentration from  $1 \times 10^{18}/\text{cm}^3$  to  $3 \times 10^{21}/\text{cm}^3$ , the MOSFET of Schunke will not operate as intended, because it will increase the electrical field beneath the gate electrode in the vicinity of a source/drain region causing increasing the hot electron phenomena.

Therefore Applicants respectfully submit that amended claim 1 is not obvious under 35 U.S.C. § 103(a) over Schunke.

Because claims 8-9, and 11 depend from amended claim 1 and add additional limitations, Applicants respectfully submit that claims 8-9, and 11 are not obvious under 35 U.S.C. § 103(a) over Schunke.

Similarly to Schunke, neither Takeuchi, Choi'582, Choi '088, Hwang, nor Wieczorek discloses, teaches, or suggests discussed above limitations of amended claim 1.

Wieczorek merely discloses source and drain regions in a substrate (Wieczorek, col. 11, lines 16-43), in contrast to a pair of silicon or silicon alloy inwardly concaved source/drain regions, as recited in amended claim 1. As such, Wieczorek does not disclose of a pair of silicon or silicon alloy inwardly concaved source/drain regions of a second conductivity type having a concentration of impurities in a range of  $1 \times 10^{18}/\text{cm}^3$  to  $3 \times 10^{21}/\text{cm}^3$  that directly define a first channel region having a first metallurgical channel length directly beneath said lower portion of said gate electrode in said first conductivity type region, and a second channel region having a second metallurgical length between said metallurgical inflection points.

Takeuchi, merely discloses elevated drain/source regions formed on a substrate, in contrast to a pair of silicon or silicon alloy inwardly concaved source/drain regions, as recited in amended claim 1. As such, Takeuchi also fails to disclose the discussed limitations of amended claim 1.

Choi ‘582 merely discloses drain/source regions, in contrast to a pair of silicon or silicon alloy inwardly concaved source/drain regions, as recited in amended claim 1. As such, Choi’582 also fails to disclose the discussed limitations of amended claim1.

Choi ‘088 merely discloses source/drain regions in contrast to a pair of silicon or silicon alloy inwardly concaved source/drain regions, as recited in amended claim 1. As such, Choi ‘088 also fails to disclose the discussed limitations of amended claim1.

Hwang merely discloses elevated source/drain regions, in contrast to a pair of silicon or silicon alloy inwardly concaved source/drain regions, as recited in amended claim 1. As such, Hwang also fails to disclose the discussed limitations of amended claim1.

Hence, none of the references cited by the Examiner discloses, teaches, or suggests the the discussed limitations of amended claim 1.

Consequently, even if Schunke, Takeuchi, Choi ‘582, Choi ‘088, Hwang, and Wieczorek were combined, such a combination would lack such limitations of amended claim 1.

Therefore, Applicants respectfully submit that amended claim 1 is not obvious under 35 U.S.C. § 103(a) over the references cited by the Examiner.

Given that claims 2-6, 8-9, and11-12 depend from amended claim 1, either directly or indirectly, and add additional limitations, Applicants respectfully submit that claims 2-6, 8-9, and11-12 are not obvious under 35 U.S.C. §103(a) over all the references cited by the Examiner.

Because amended independent claims 13 and 15 contain at least the same limitations as amended claim 1, Applicants respectfully submit that claims 13 and 15 are likewise not obvious under 35 U.S.C. §103(a) over all the references cited by the Examiner.

Given that claim 14 depends directly from claim 13 and add additional limitations, applicants respectfully submit that claim 14 is likewise not obvious under 35 U.S.C. §103(a) over all the references cited by the Examiner.

**CONCLUSION**

It is respectfully submitted that in view of the amendments and arguments set forth herein, the applicable rejections and objections have been overcome. If there are any additional charges, please charge Deposit Account No. 02-2666 for any fee deficiency that may be due.

Respectfully submitted,

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